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Fire suppression in 21st century subalpine forests of Greater Yellowstone

Winslow D. Hansen[1], Werner Rammer[2], Rupert Seidl[2] and Monica G. Turner[1]

[1]Department of Integrative Biology, University of Wisconsin, Madison, Madison, WI
[2]Department of Forest- and Soil Sciences, University of Natural Resources and Life Sciences (BOKU) Vienna, Wien, Austria

Background/Question/Methods

Warming and drying in subalpine forests of the western United States have caused large upticks in the number and area burned by wildfires. These trends should continue in the 21st century and the resilience of subalpine forests may be exceeded. How the suppression of subalpine fires might mediate 21st-century climate-fire trends has not been evaluated, however. Fire managers can effectively suppress smaller fires under average weather conditions, but larger fires that burn under drought and severe winds are not suppressible. Twentieth-century observations suggest that suppression of subalpine fires has not influenced subsequent fire size or forests−unlike in dry conifer forest types. We used a process-based model, iLand, to assess whether 20th-century observations hold under 21st-century conditions by characterizing *how a* c*ontemporary subalpine landscape would be different if fires had not been suppressed over the last three decades and how letting fires burn affects 21st century fire and forests.* We simulated a ~60,000-ha forest landscape in Grand Teton National Park from 1989-2099 with one scenario in which all fires were suppressed when weather conditions were average and another scenario where all fires burned without suppression. We compared cumulative area burned, percent non-forested area, forest age, and tree-species composition.

Results/Conclusions

On average, 200 more ha yr^{-1} burned when fires were not suppressed between 1989 and 2017. Forest structure and composition changed little by 2017, irrespective of fire suppression. In the 21st century, cumulative area burned grew faster when fires were not suppressed. By 2099, almost twice as much area had burned. However, climate change had a much stronger effect on 21st-century forest age and composition than fire suppression. Stand age declined. By 2099, young stands made up ~85% of forestedarea, irrespective of suppression scenario. Lodgepole pine dominance declined markedly and was replaced by Douglas-fir. In an uncertainty analysis where fire sizes were further increased, climate thresholds were crossed in the mid-21st century, initiating nonlinear growth in burned area. This caused percent non-forested area to abruptly increase; approximately 35% of stockable area became non-forested by 2099. It appears that fire suppression could reduce 21st-century burned area but may only have a small to modest effect on forests. Instead, climate change will likely be a far more important determinant of forest age, composition, and extent. Thus, managers could have great flexibility to strategically suppress subalpine fires with few consequences for 21st-century forests.